

$$E=mc^2$$







*Anytime*



*Anywhere*



*Any Device*



A graphic illustration on the left side of the slide. It features a radio tower standing on the curved horizon of a globe, which shows green landmasses and blue oceans. The background behind the tower is a vibrant, fiery orange and yellow, suggesting a sunrise or sunset. The right side of the slide has a solid blue background with a subtle horizontal gradient.

# **The Radio Renaissance**

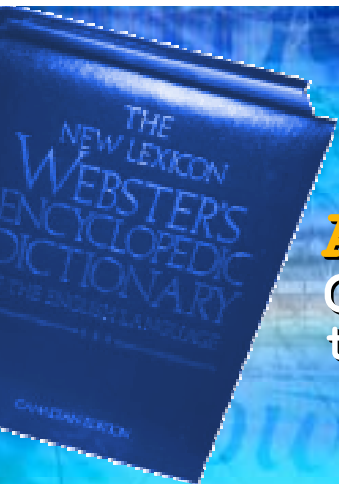
**Patrick P. Gelsinger**  
Senior Vice President  
Chief Technology Officer



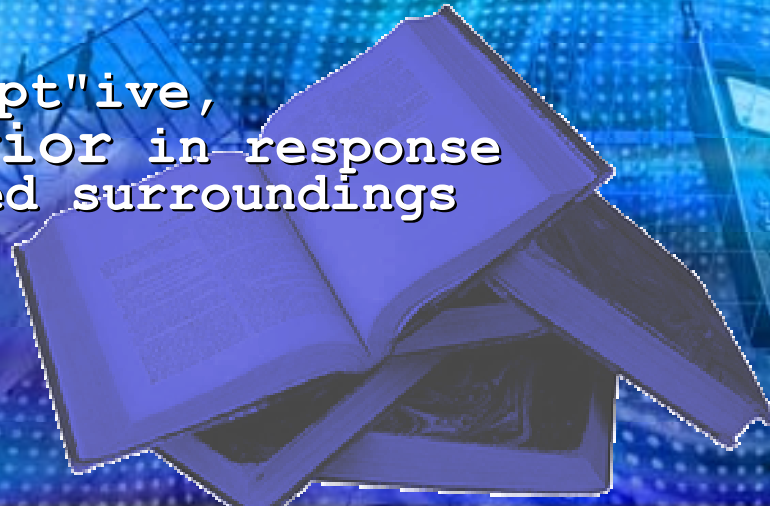


**Transparent**





**Adaptive** A\*dapt"ive,  
Change in behavior in response  
to new or modified surroundings



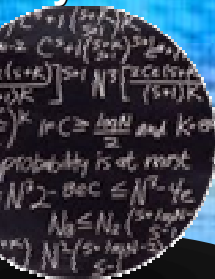
The background of the advertisement is a vibrant blue and purple digital landscape. It features a grid of glowing squares, some of which are larger and more prominent. In the upper left, there's a stylized representation of a city or a complex network of nodes. In the lower right, a mobile phone is shown with a glowing screen and a keypad. The overall aesthetic is futuristic and high-tech, with a strong emphasis on connectivity and data flow.

# Radio Free Intel

A detailed microchip is shown in the lower left corner, tilted at an angle. It is surrounded by three concentric white circles that resemble signal waves emanating from the chip. The chip itself is a complex of various colored components, including gold, red, and blue, set against a dark background.

Fully **integrated**  
Always **connected**  
Multiple **networks**

Adapting to  
Physics



Adapting to  
the Network



Adapting  
to the User



**Radio Free Intel**

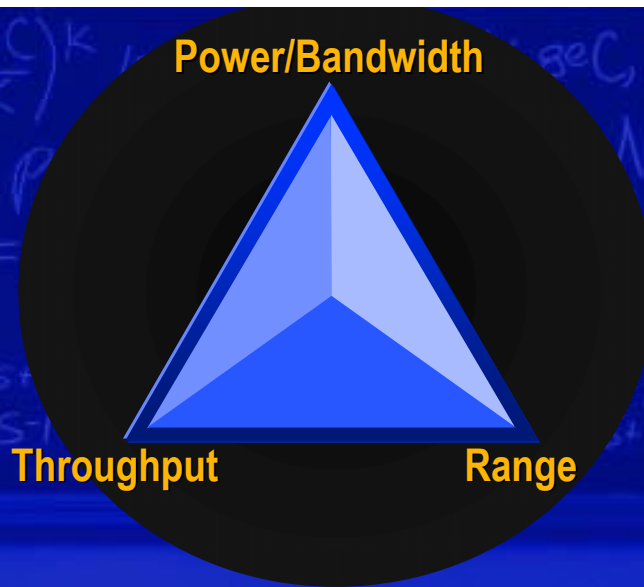
*System-level  
Innovation*





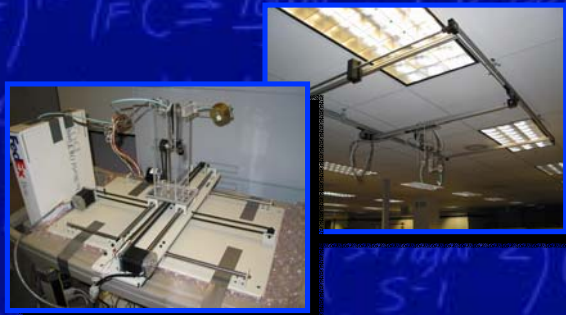
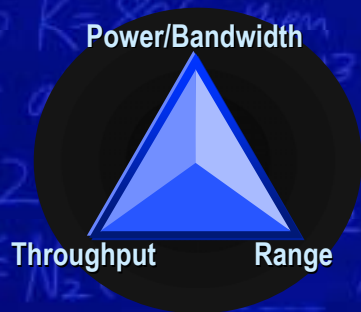
# Adapting to Physics

## Wireless Performance



# Adapting to Physics

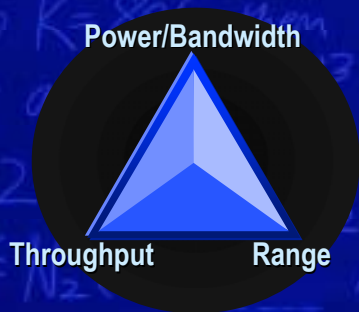
## Wireless Performance



## Channel Estimation

## Adapting to Physics

### Wireless Performance



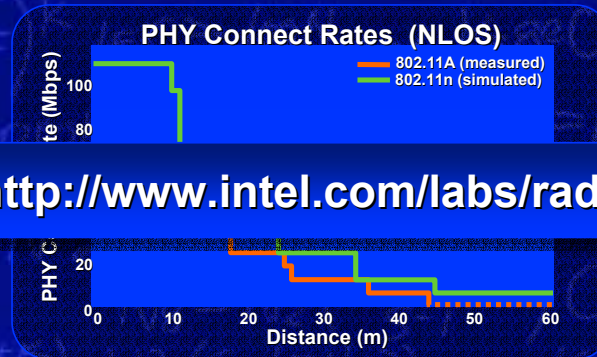
Play avi in  
media player

Channel Estimation



# Adapting to Physics

## Wireless Performance

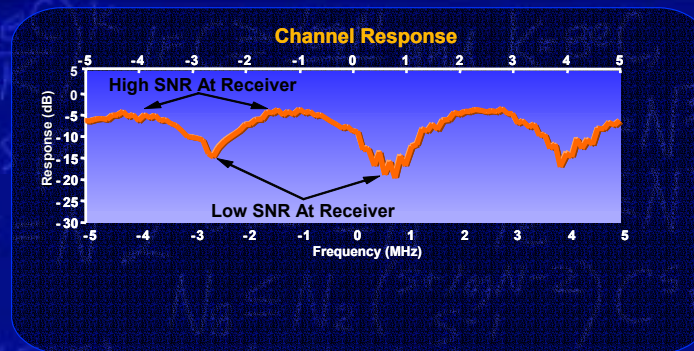
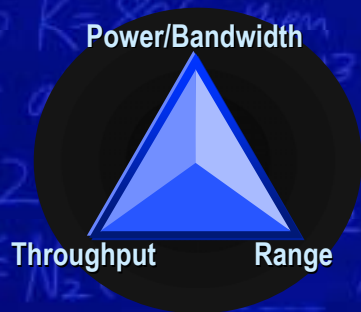


<http://www.intel.com/labs/radio>

## Channel Estimation

# Adapting to Physics

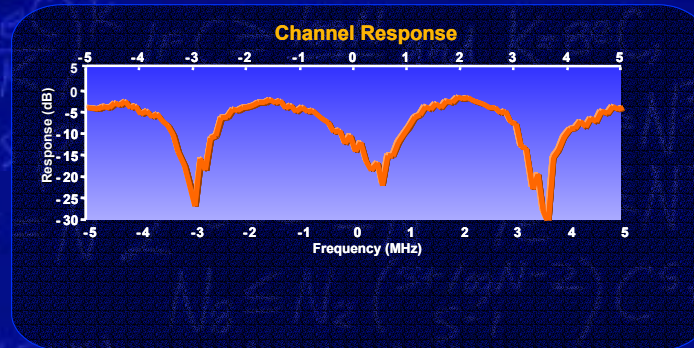
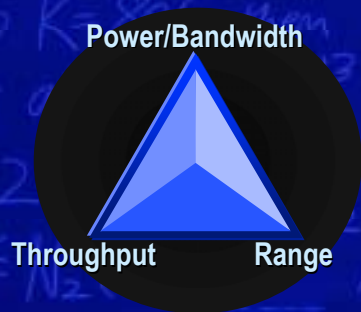
## Wireless Performance



## Adaptive Modulation

# Adapting to Physics

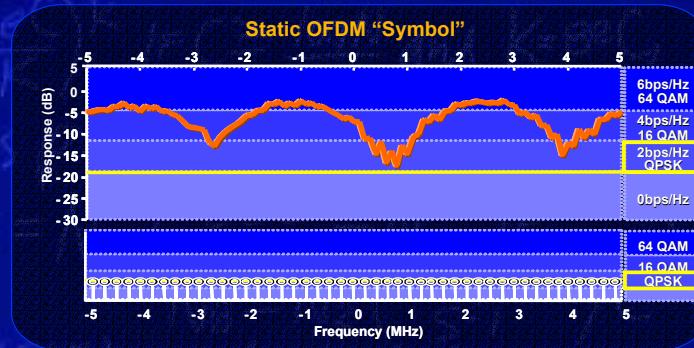
## Wireless Performance



## Adaptive Modulation

# Adapting to Physics

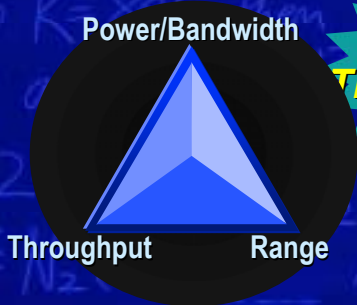
## Wireless Performance



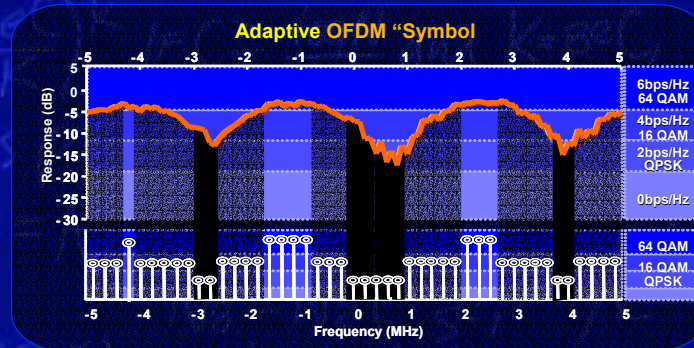
## Adaptive Modulation

# Adapting to Physics

## Wireless Performance



**2X  
Throughput**

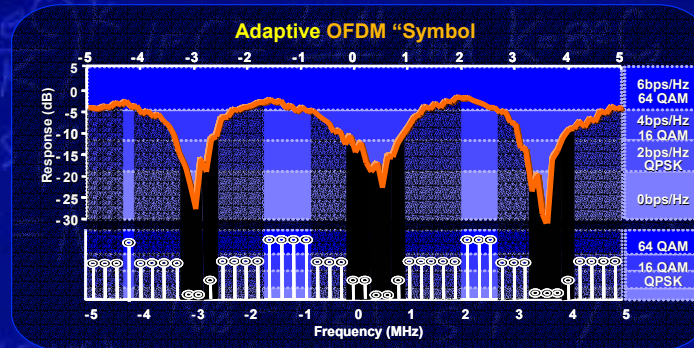
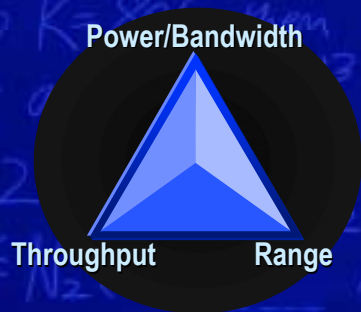


## Adaptive Modulation



# Adapting to Physics

## Wireless Performance



## Adaptive Modulation



# Adapting to Physics

## Wireless Performance

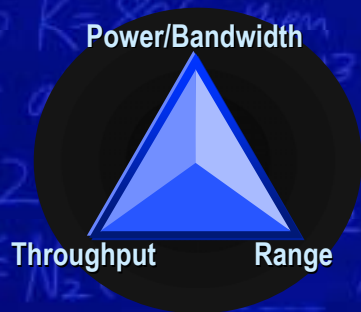


Play exe

Smart Antenna Systems

# Adapting to Physics

## Wireless Performance

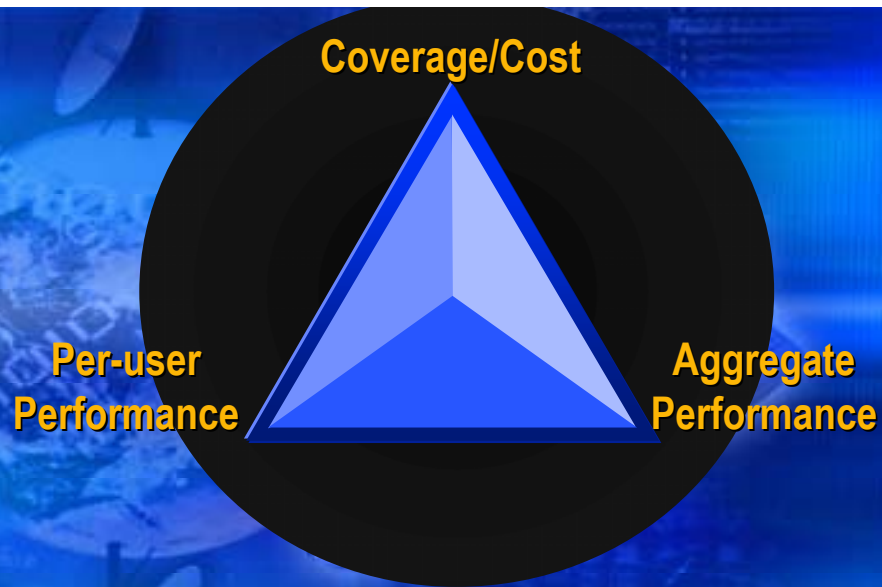


**Multiple** Input  
**Multiple** Output

**Smart Antenna Systems**

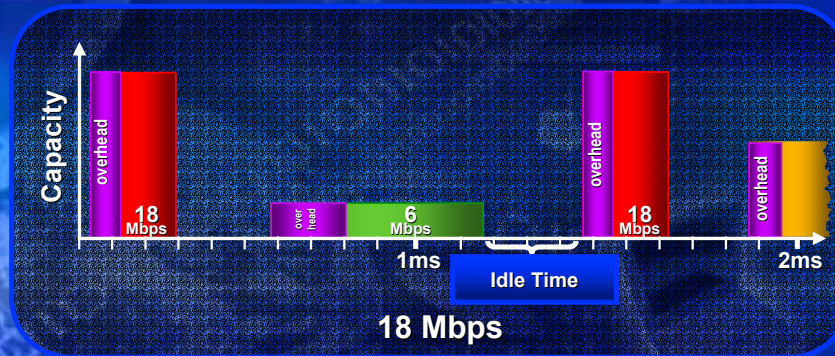
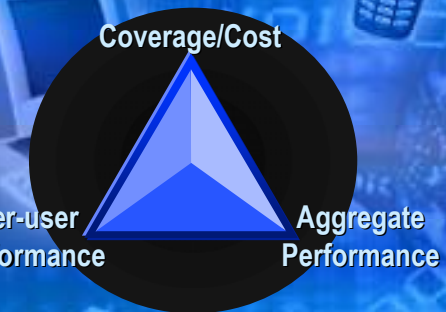
# Adapting to the Network

System Performance



# Adapting to the Network

## System Performance

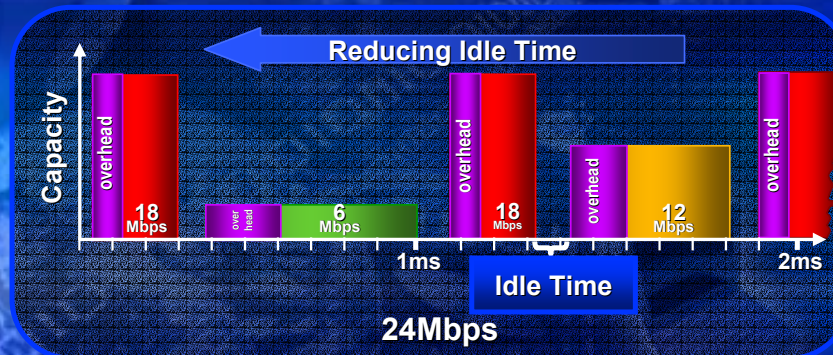
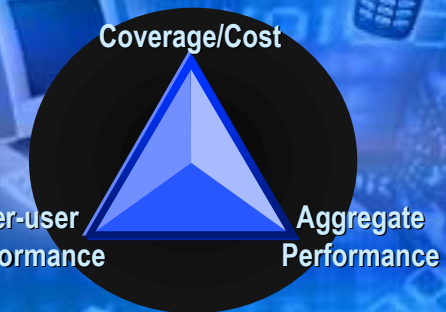


## Adaptive MAC



# Adapting to the Network

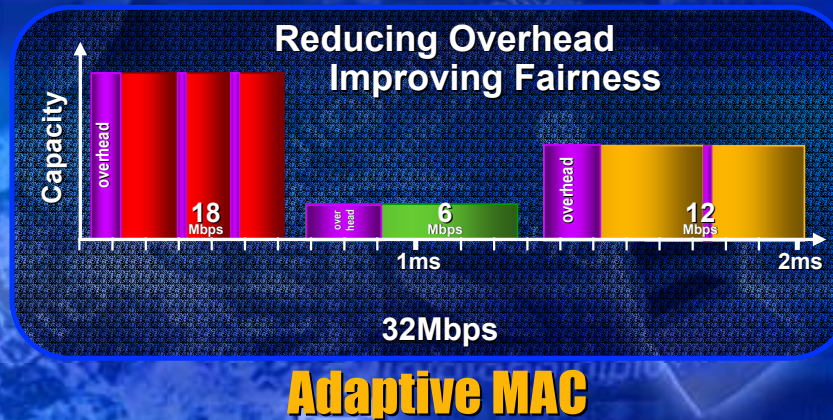
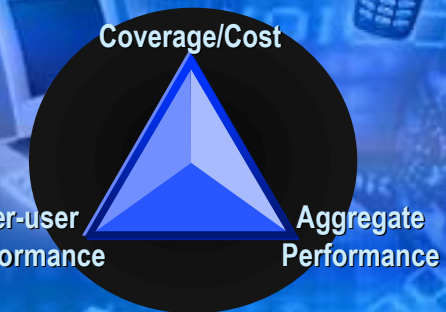
## System Performance



## Adaptive MAC

# Adapting to the Network

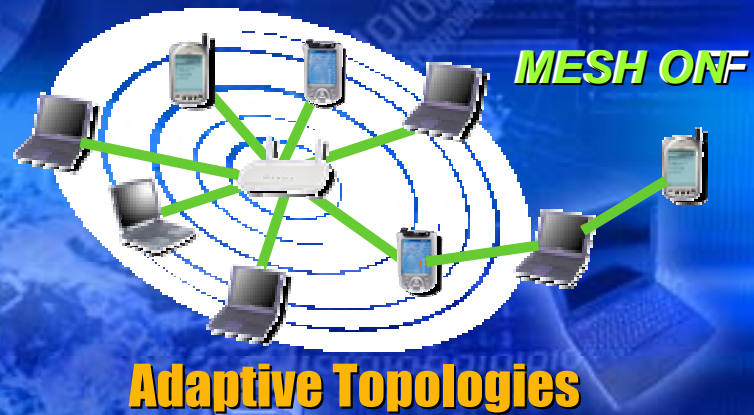
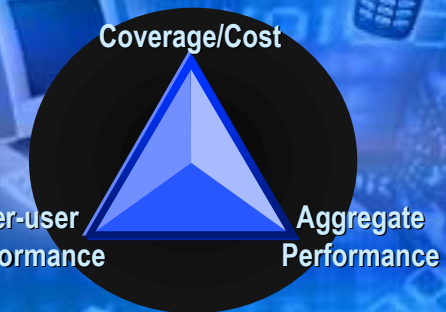
## System Performance





# Adapting to the Network

## System Performance



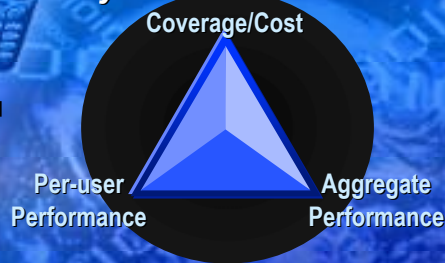
**Adapting to Physics**

*Wireless Performance*



**Adapting to the Network**

*System Performance*



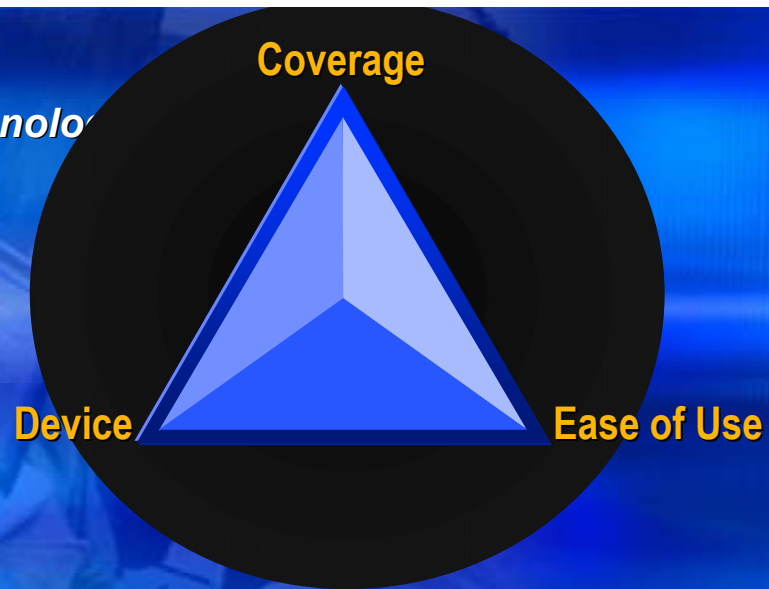
**Next  
Generation  
Networks**

The image features two RJ45 network connectors, one on the left and one on the right, facing each other. The background is a deep blue with a subtle pattern of radiating lines emanating from the space between the connectors, creating a sense of energy or signal flow. The overall aesthetic is technological and modern.

**No More Copper!**

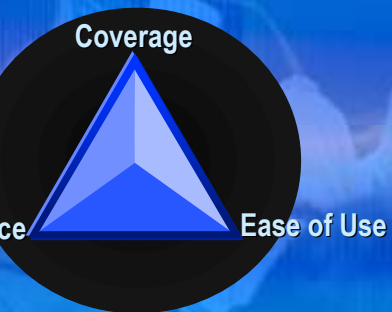
# Adapting to the User

*Adaptive Communication Technology*



# Adapting to the User

## Adaptive Communication Technology



### Research

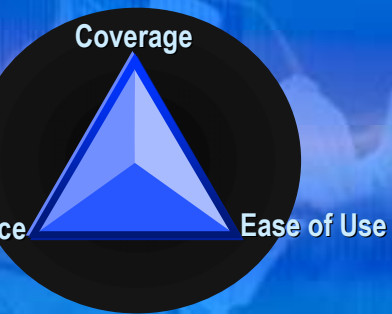
- powerful, flexible platforms
- trust identity, authentication
- cross device collaboration
- efficient power management
- intelligent network





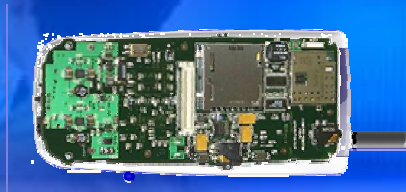
# Adapting to the User

## Adaptive Communication Technology



### Research

- powerful, flexible platforms
- trust identity, authentication
- cross device collaboration
- efficient power management
- intelligent network

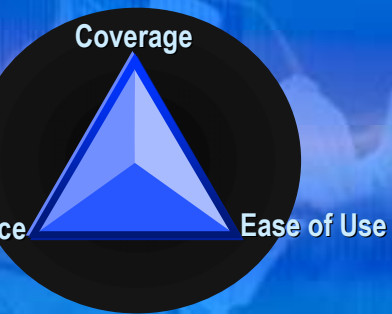


### Universal Communicator



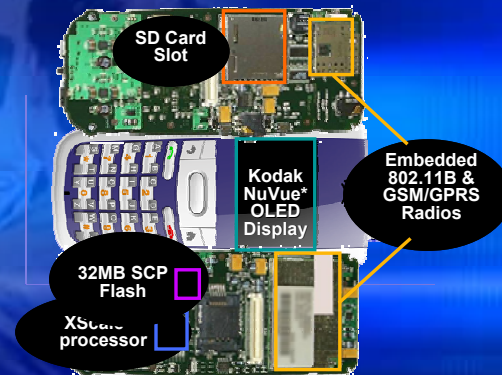
# Adapting to the User

## Adaptive Communication Technology



### Research

powerful, flexible platforms  
trust identity, authentication  
cross device collaboration  
efficient power management  
intelligent network

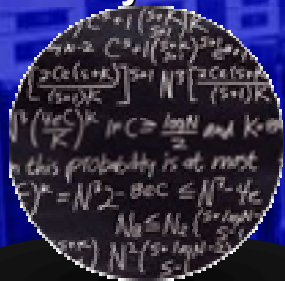


### Universal Communicator

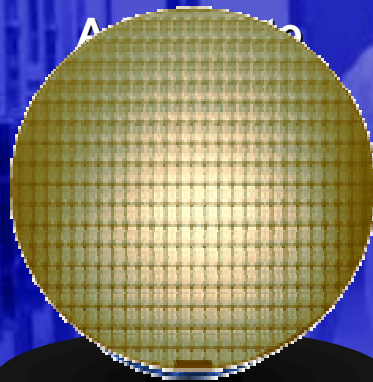
\*other brands and names are the property of their respective owners.

# Silicon Is The Enabler

Adapting to  
Physics



Adapting to



Adapting  
to the User

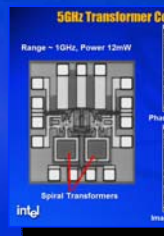


Moore's law

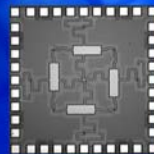
Fundamental Trajectory

Monolithizing  
radios

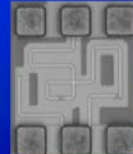
software defined radio  
VCO  
power amplifier  
low noise amplifier  
synthesizer  
high quality passives



### CMOS Oscillators at >75GHz



4 transistor design



1 transistor design

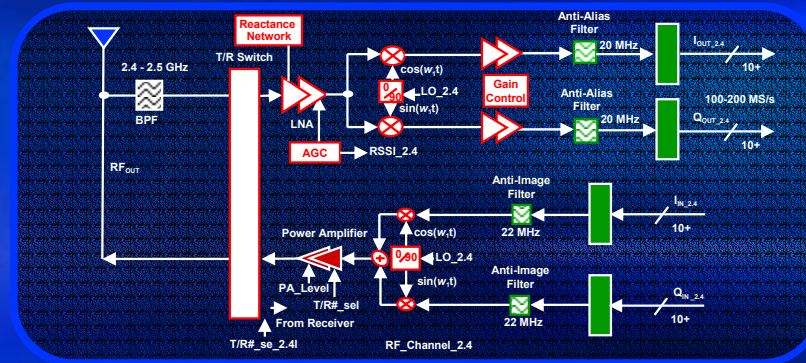
- 90 nm digital CMOS process: Low V device used
  - Low V digital device speed can be used effectively
  - Highest speed oscillator achieved in CMOS
  - Scaling CMOS benefits microwave circuits
- intel

Intel Labs



# Moore's law Fundamental Trajectory

## Today's Radio Analog Direct Conversion

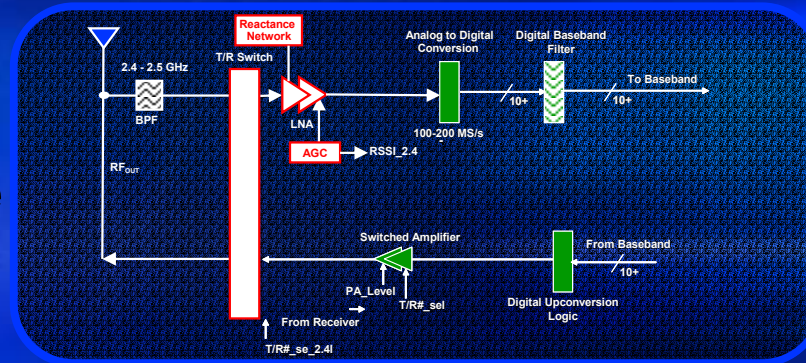




Moore's law

Fundamental Trajectory

Radio Renaissance  
Digital Direct Conversion







## Our Collective Responsibility



**Standards**



**Technology  
Deployment**

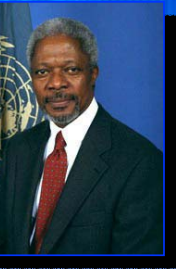


**Solutions**



**Regulations  
& Policy**

## **Our Collective Opportunity**



Secretary-General  
r. Kofi Annan

*“... the swift emergence of a global information society is changing the way people live, learn, work, and relate...”*

*Wireless technologies have a key role to play everywhere, but especially in developing countries and countries with economies in transition.”*

**Digital** Convergence

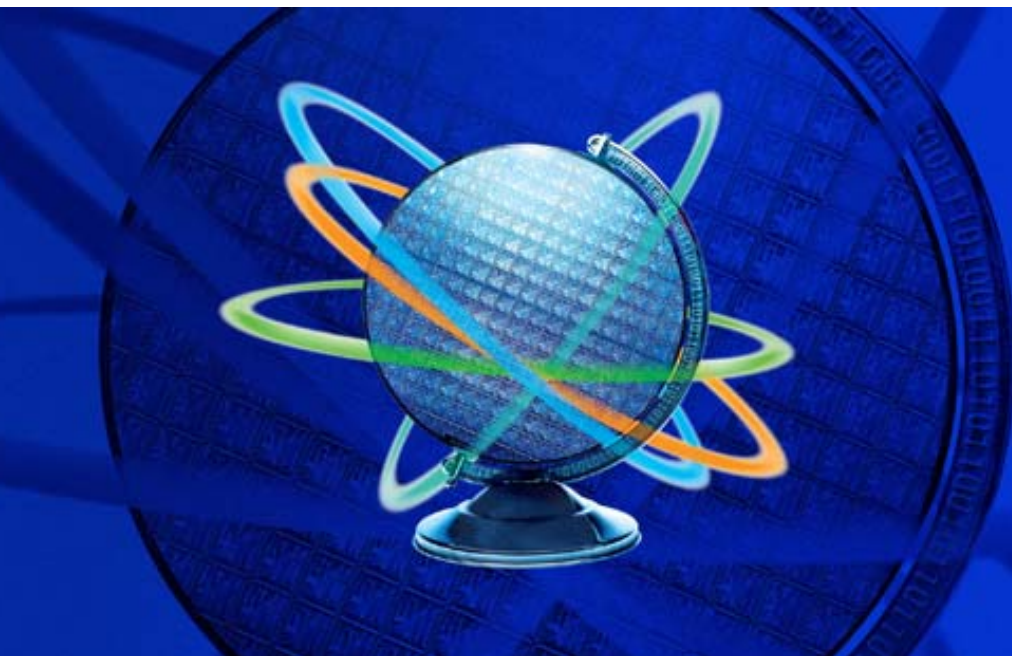
all computers

communicate

Transparent Communication

**The Radio Renaissance**

Involves a computer



Intel  
**Developer**  
Forum.